Federal Aviation Administration

New Airport Design

150/5300-13A

Overview

Presented to: Recurrent Engineering – Palm Coast, FL

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Date: November 7, 2012

We Plan to Cover

- When to adopt the new AC?
- When to mitigate problematic geometry?
- Principal changes, clarifications, updates & improvements
- New method for “Fillet Design”
- Any correlation between existing ADG & new TDG fillet ?
- Airfield development alternative - using 13A
- RPZ review process

13A - Applicability

- Use 13A for all airport planning and design contracts signed after September 28, 2012.
- If a grant was received for engineering and planning and the scope was based on the old 5300-13; Please review 13A and consult with your FAA project manager before making changes to the scope of work.

When to mitigate Hot Spots

In addition to raising awareness of problematic geometry at an airport, locations designated as “Hot Spot” should receive priority attention when a capital project is at that location:

- New construction funded under AIP or PFC
- High priority to fix Hot Spots adjacent to runways
- Other non-standard intersections to be considered as soon as practicable

Principal Changes & Clarifications

- An expanded discussion on Declared Distances
- Updated Runway Protection Zone Standards (& interim guidance)
- Guidance for new runway geometry (runway incursion prevention)
- New Runway Design Code (RDC) designation
- New Runway Reference Code (RRC) designation
- Longitudinal Grades
- Transverse Grades & ROFA
- Design Aircraft
- New taxiway fillet design methodology (Taxiway Design Group)
- New language on paved shoulders

Updates & Improvements

- Precision Object Free Zone & Displaced Threshold
- A revised “End Around Taxiway” geometry
- Airfield Development Alternatives
- Updated Aircraft Data Base – Appendix 1
- Revised Wind Rose – Appendix 2
- New [interactive] table 3-8 for Runway Design Standard Matrix
- New PDF Format – searchable with electronic bookmarks and hyperlinks
- Improved and consolidated tables
- New and improved figures
- Pulled appendices into chapters
- Revised and organized chapters

Runway Protection Zone (RPZ)

http://gma.yahoo.com/blogs/abc-blogs/suv-and-plane-collide-at-texas-airport.html

Definition: To enhance the protection of people and property on the ground.

- Central Portion of the Runway Protection Zone (RPZ)
- Controlled Activity Area of the RPZ
- RPZ *may be* mitigated by Declared Distances
- When threshold is displaced there may be two RPZ on Runway End; Approach and Departure

✓ **Permissible RPZ use listed in 13A:**

- ✓ Farming that meets the minimum buffers as shown in Table 3-10 of 13A.
- ✓ Irrigation channels as long as they do not attract birds.
- ✓ Airport service roads, as long as they are not public roads and are directly controlled by the airport operator.
- ✓ Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable.
- ✓ Unstaffed NAVAIDs and facilities, such as equipment for airport facilities that are considered fixed-by-function in regard to the RPZ

Evaluation Process

- Evaluation and approval of RPZ Land Use guidelines will outline the procedures to review the proposed land use that is not on the permissible list. This guidance is currently being developed by APP and AAS. (Interim guidance in 9/27/12 APP-1 memo).

- Office of Airports must evaluate and approve the proposed land use that is not on the permissible list.

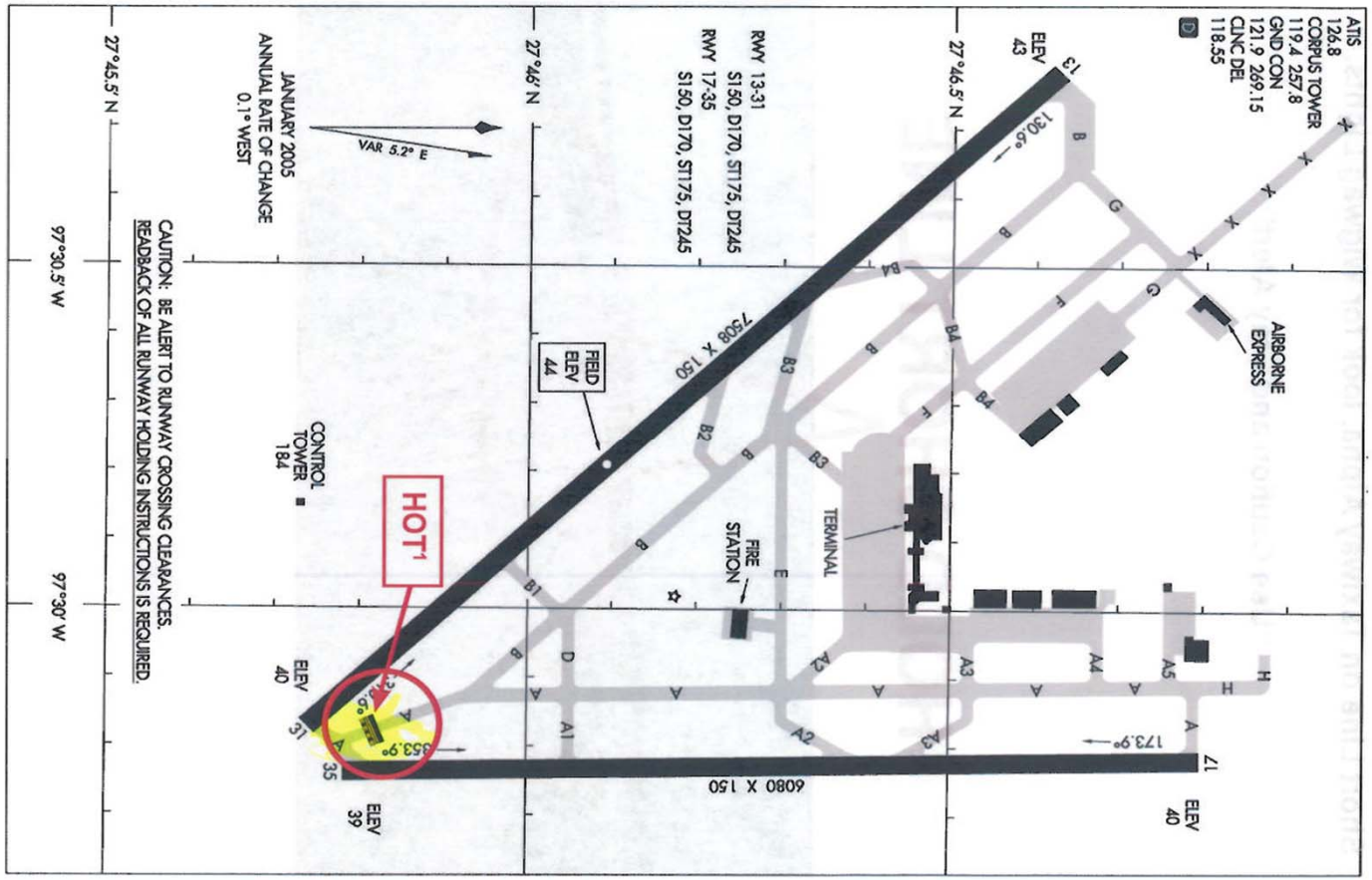
Non - Intersecting Runways

Design Guidance**:**

- ❑ Each Runway should maintain an independent RSA
- ❑ Minimize RSA overlap
- ❑ Adjacent runway threshold should be avoided
- ❑ Angle between extended runway centerlines should not be less than 30 degrees
- ❑ Benefits:
  - ✓ Decrease the chances of Runway Incursion
  - ✓ Decrease the overlapping RSA
  - ✓ Decrease the chances of confusing marking & lighting

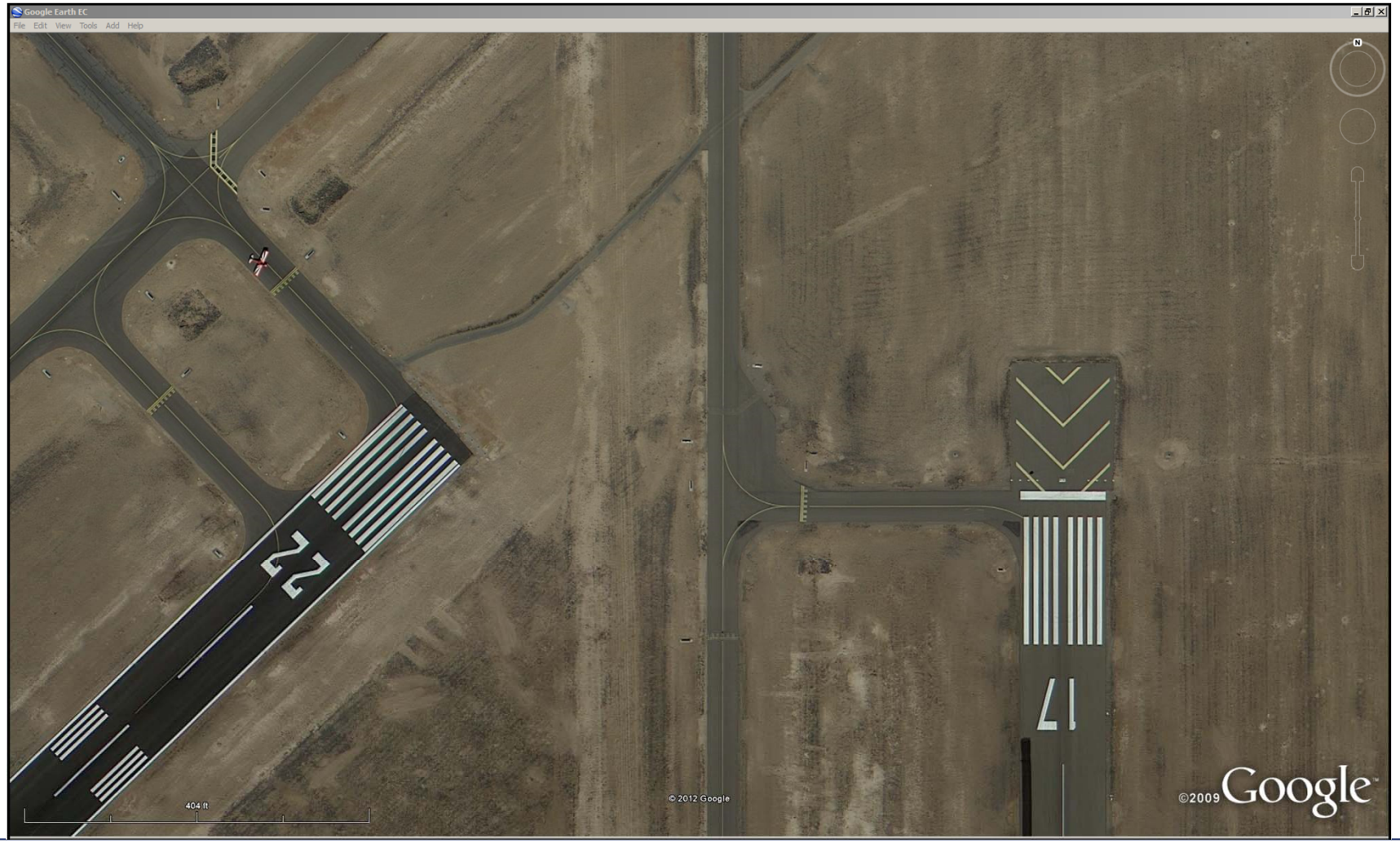
Avoid Overlapping RSAs

Open V


ATIS
126.8
CORPUS TOWER
119.4 257.8
GND CON
121.9 269.15
CLNC DEL
118.55
AIRBORNE EXPRESS
ELEV 43
ELEV 40
27°46.5' N
27°45.5' N
97°30.5' W
97°30' W
RWY 13-31
S150, D170, ST175, DT245
RWY 17-35
S150, D170, ST175, DT245
7508 X 150
6080 X 150
FIELD ELEV 44
CONTROL TOWER 184
TERMINAL
FIRE STATION
HOT1
ELEV 40
ELEV 39
VAR 5.2° E
JANUARY 2005
ANNUAL RATE OF CHANGE
0.1° WEST
CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES.
READBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.

Avoid Adjacent Threshold Configurations

Example of Acceptable Open V

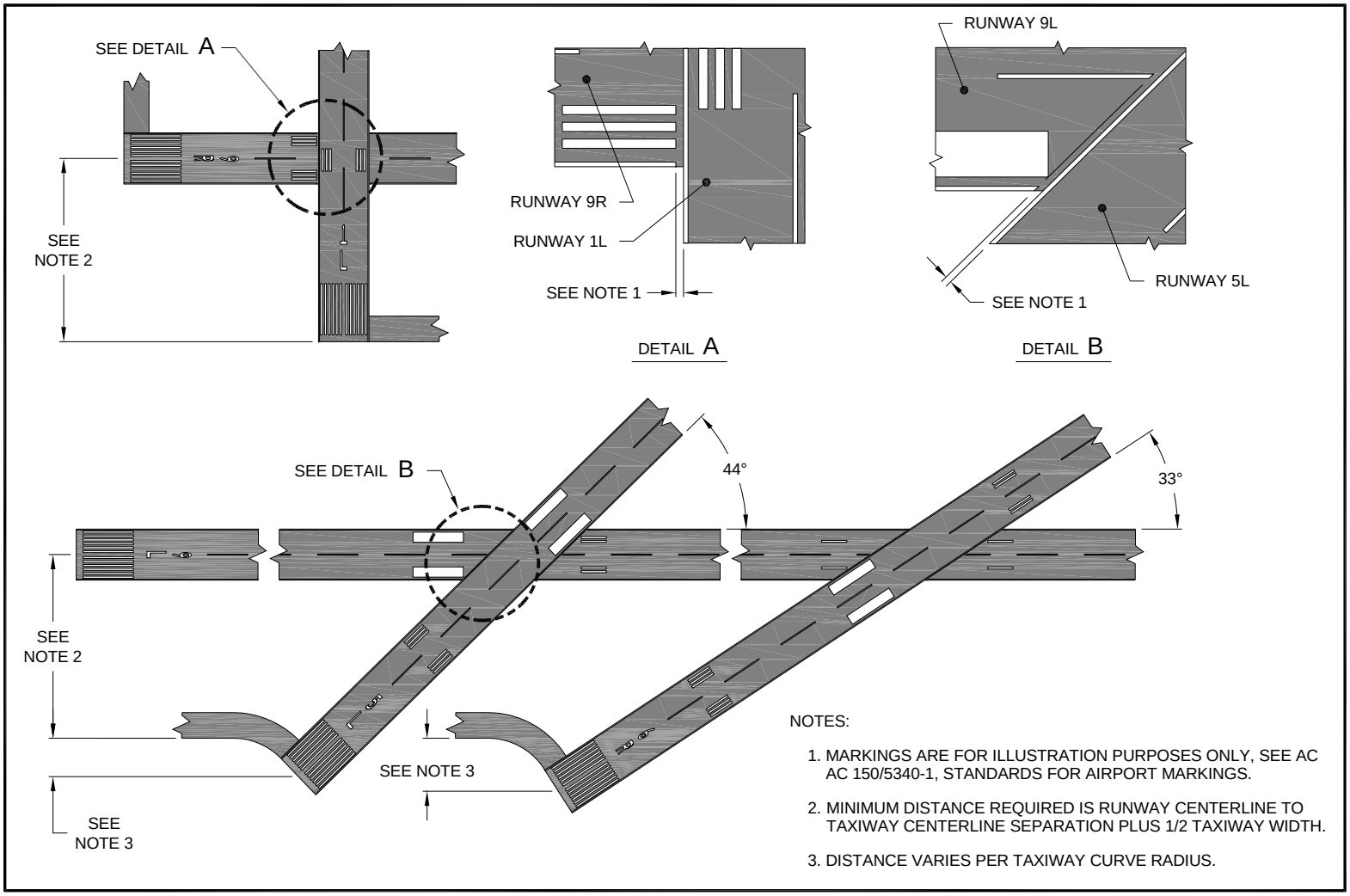


Intersecting Runways

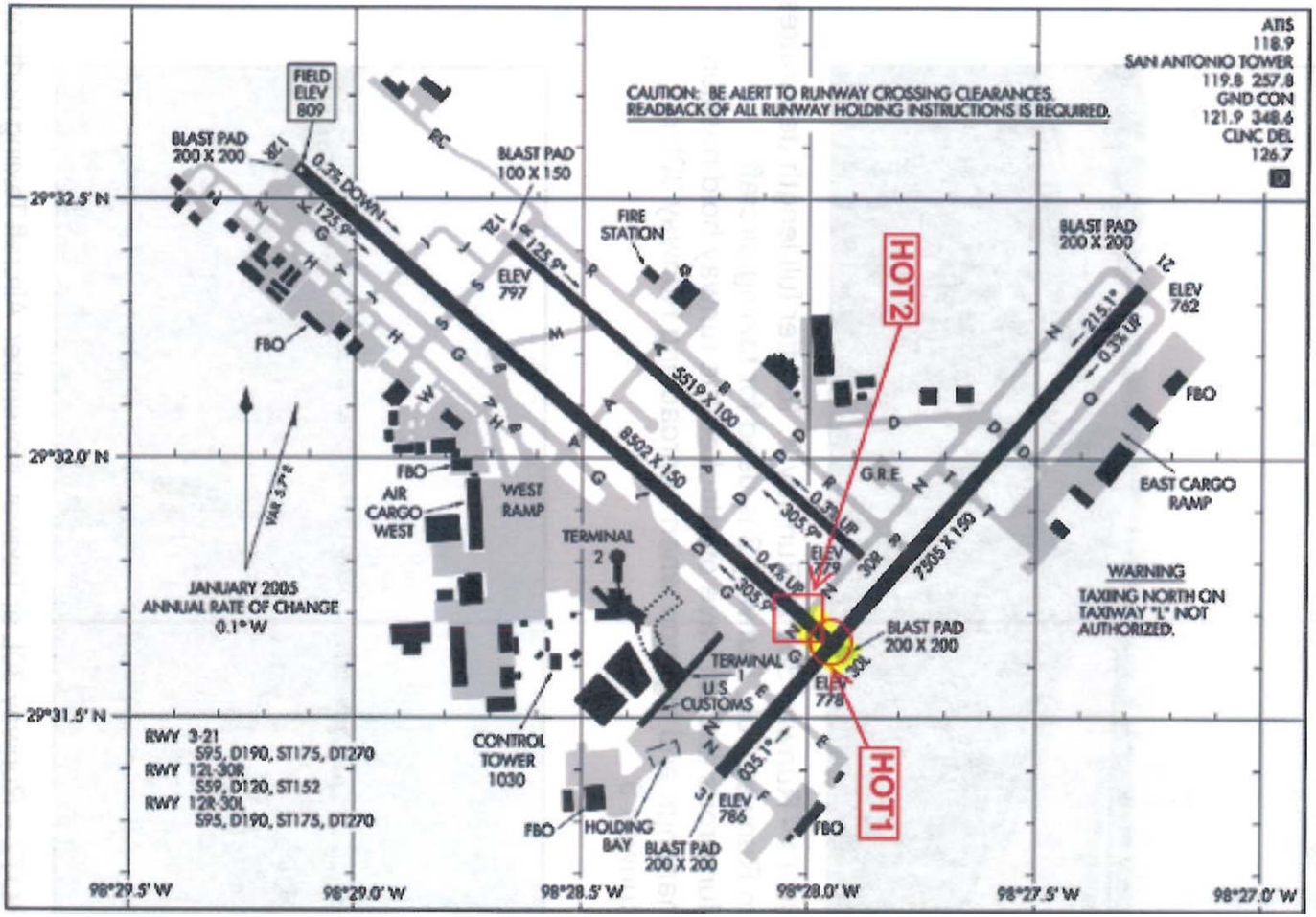
Design Guidance:

- Angle between primary runway centerline and intersecting runway should not be less than 33 degrees
- Maintain a minimum allowed distance between primary runway threshold and intersecting runway threshold
- Benefits:
  - ✓ Proper application of runway marking standards
    - Touchdown zone marking
    - Aiming point marking
  - ✓ Enhances pilot's perception
  - ✓ Minimize runway incursion incidents

New Guidance

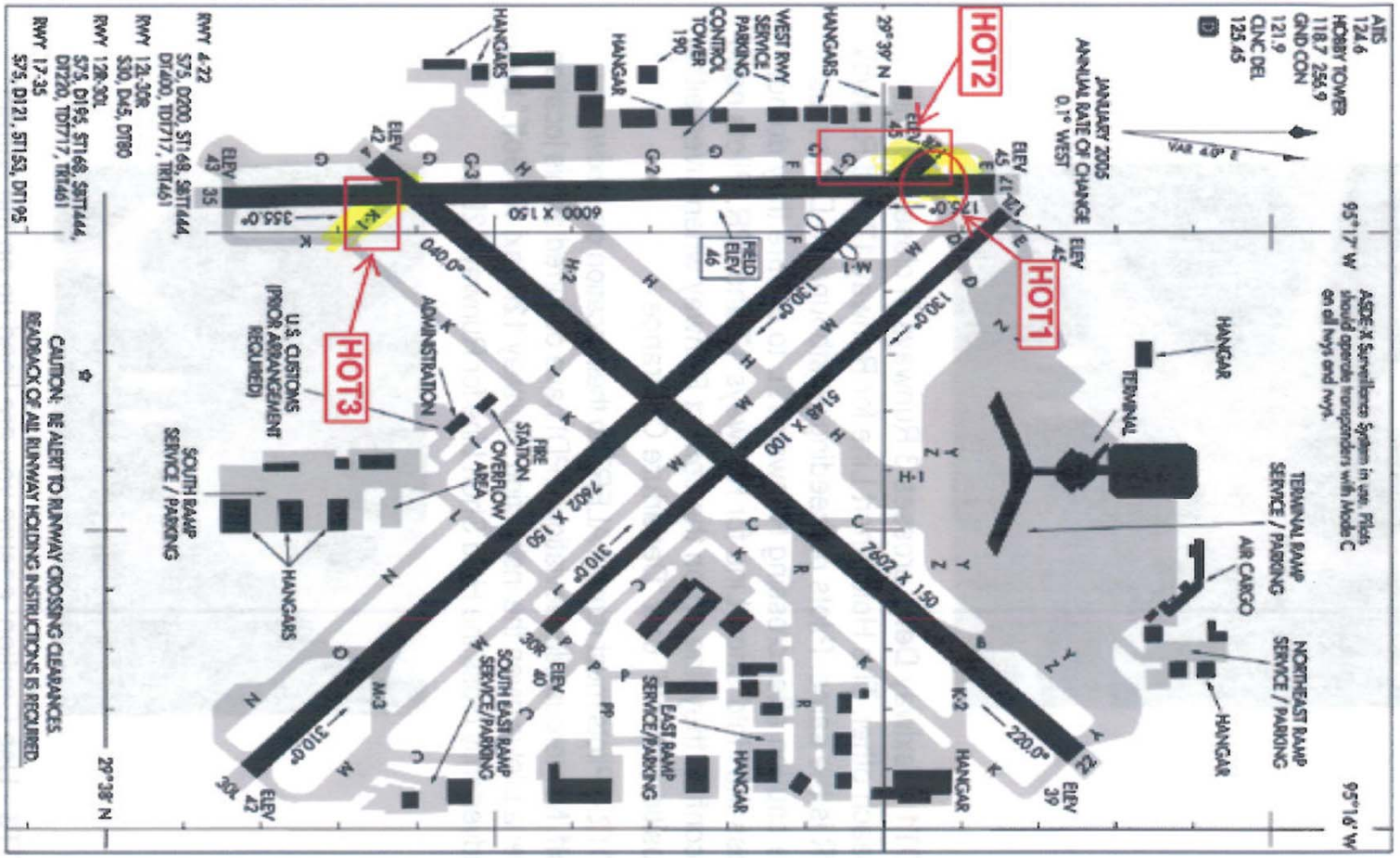


T - Configuration



Avoid Marking Adjustments

Intersections with Hot Spots



Avoid Primary Runway < 33^0

Runway Design Code (RDC)

- **Purpose**
  - Provides information to determine applicable design standards
- **Components**
  - Aircraft Approach Category (A,B,C,D)
  - Airplane Design Group (I, II, III, IV, V, VI)
  - Visibility minimums expressed by RVR values:

RVR (ft)	Flight Visibility Category (statute mile)
4000	Lower than 1 mile but not lower than ¾ mile (APV ≥ 3/4 but < 1 mile)
2400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)
1600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)
1200	Lower than 1/4 mile (CAT-III PA)

  - Without visibility restrictions third component reads ‘VIS”
- **Example on ALP**
  - Air carrier runway C-IV-1600
  - General Aviation runway B-II-2400

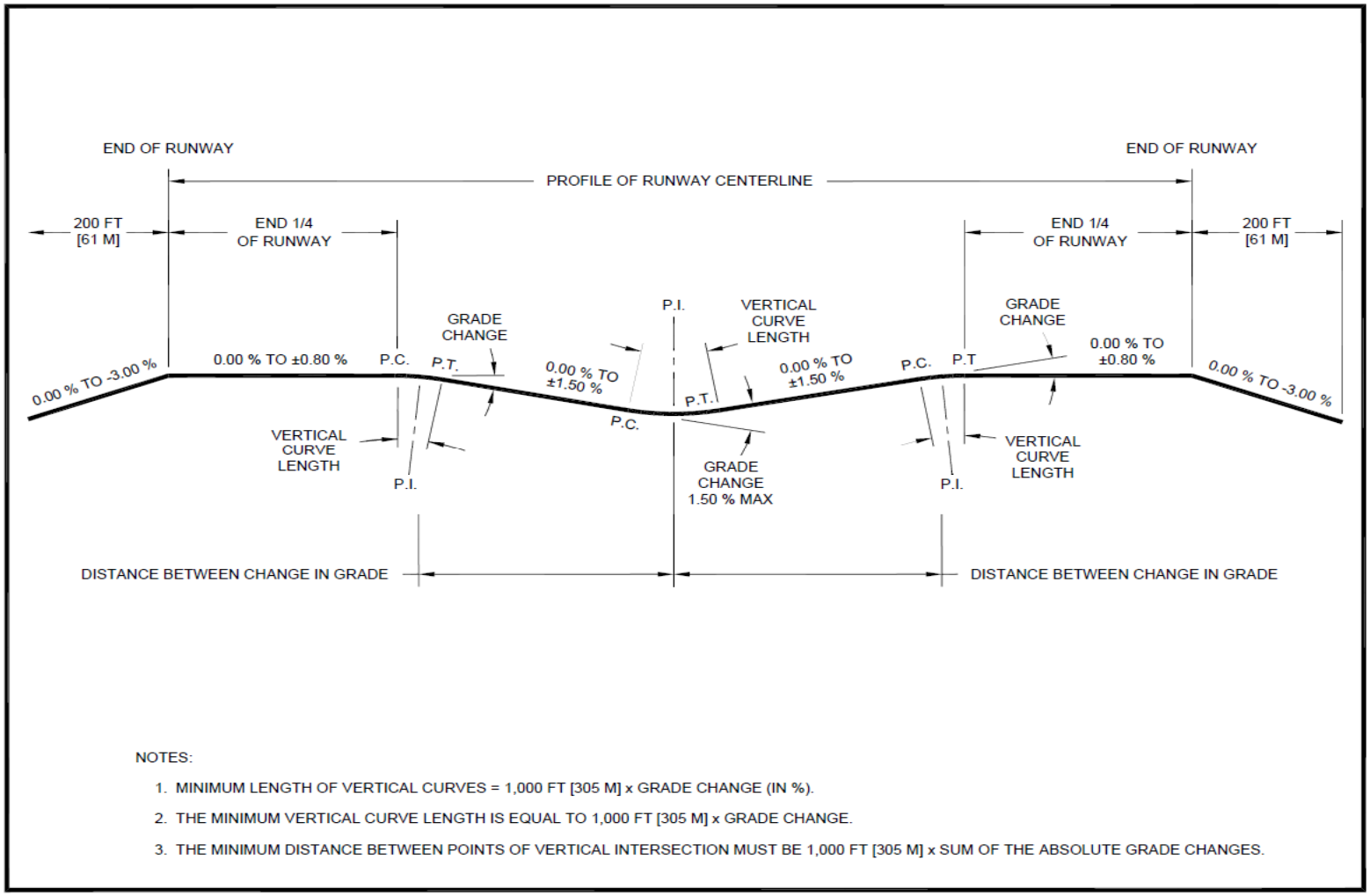
Runway Reference Code (RRC)

- **Describes the current operational capabilities of a runway where no special operating procedures are necessary.**
  - ✓ It is similar to RDC – composed of the same three components
  - ✓ RRC may change over time as improvements are made to the runway and NAVAIDS
  - ✓ A runway may have more than one RRC: D/V/2400 and D/VI/1600

Table 3-7. Minimum runway to taxiway separation / RRC - approach categories C, D, and E

Visibility Minimums		ADG					
		I	II	III	IV	V	VI
Not lower than 3/4 mile	Runway to Taxiway Separation	300	300	400	400	400	500
	RRC	C/I/4000 D/I/4000 E/I/4000	C/II/4000 D/II/4000 E/II/4000	C/III/4000 D/III/4000 E/III/4000	C/IV/4000 D/IV/4000 E/IV/4000	C/V/4000 D/V/4000 E/V/4000	C/VI/4000 D/VI/4000 E/VI/4000
Lower than 3/4 mile but not lower than 1/2 mile	Runway to Taxiway Separation	400	400	400	400	400	500
	RRC	C/I/2400 D/I/2400 E/I/2400	C/II/2400 D/II/2400 E/II/2400	C/III/2400 D/III/2400 E/III/2400	C/IV/2400 D/IV/2400 E/IV/2400	C/V/2400 D/V/2400 E/V/2400	C/VI/2400 D/VI/2400 E/VI/2400
Lower than 1/2 mile	Runway to Taxiway Separation	400	400	400	400	500	550
	RRC	C/I/1600 D/I/1600 E/I/1600	C/II/1600 D/II/1600 E/II/1600	C/III/1600 D/III/1600 E/III/1600	C/IV/1600 D/IV/1600 E/IV/1600	C/V/1600 D/V/1600 E/V/1600	C/VI/1600 D/VI/1600 E/VI/1600

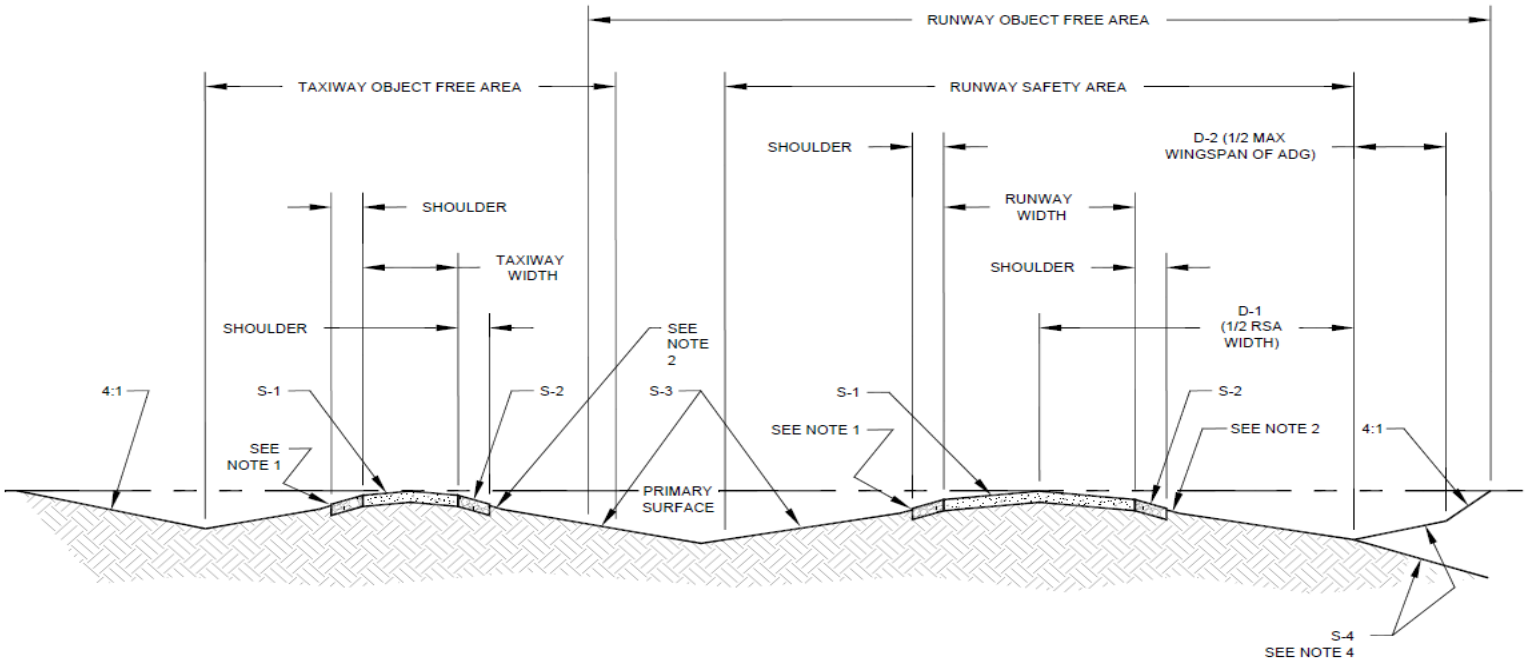
Longitudinal Grade – C,D & E



NOTES:

1. MINIMUM LENGTH OF VERTICAL CURVES = 1,000 FT [305 M] x GRADE CHANGE (IN %).
2. THE MINIMUM VERTICAL CURVE LENGTH IS EQUAL TO 1,000 FT [305 M] x GRADE CHANGE.
3. THE MINIMUM DISTANCE BETWEEN POINTS OF VERTICAL INTERSECTION MUST BE 1,000 FT [305 M] x SUM OF THE ABSOLUTE GRADE CHANGES.

Transverse Grade



NOTES:

1. CONSTRUCT A 1.5 IN [4 cm] PAVEMENT EDGE DROP BETWEEN PAVED AND UNPAVED SURFACES.
2. MAINTAIN A -5.0 % GRADE FOR 10 FEET OF UNPAVED SURFACE ADJACENT TO THE PAVED SURFACE.
3. S-2 APPLIES WHEN SHOULDERS ARE PROVIDED.
4. S-4 SHOULD BE 0% OR NEGATIVE TO THE EDGE OF THE RUNWAY OFA IF PRACTICABLE. ALLOWABLE POSITIVE SLOPE BASED ON AIRPLANE DESIGN GROUP.

APPROACH CATEGORY	A & B	C, D, AND E
S-1	1.0% TO 2.0%	1.0% TO 1.5%
S-2 (≥S-1)	1.5% TO 5.0%	1.5% TO 5.0%
S-3	1.5% TO 3.0%	1.5% TO 3.0%

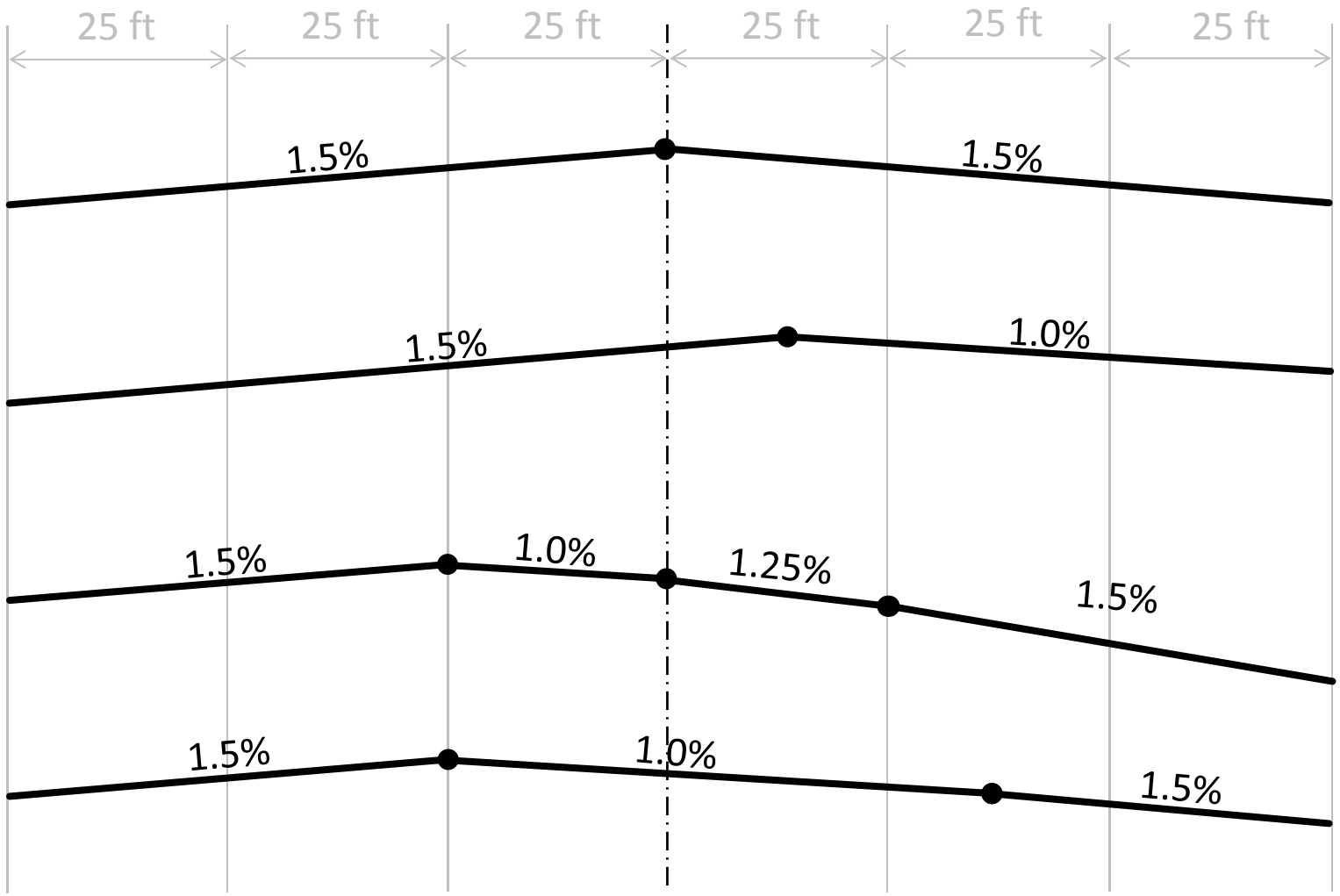
ADG	I	II	III	IV	V	VI
D-1	SEE TABLE 3-8					
D-2	25	40	59	86	107	131
S-4 (MAXIMUM)	8:1		10:1		16:1	

Runway Transverse Grade

- **Paragraph 313 b. (5):**

  … Keep transverse grades to a minimum and consistent with local drainage requirements. The ideal configuration is a center crown with equal constant transverse grades on either side. However, an off-center crown, different grades on either side, and changes in transverse grade (other than from one side of the crown to the other) of no more than 0.5 percent more than 25 feet (7.6m) from the runway crown are permissible.

Runway Transverse Grades



Aircraft Approach Categories C, D, and E

Design Aircraft

- **Enables planners and engineers to satisfy operational requirements of such aircraft.**
- **Meet national standards for :**
  - Separation
  - Geometric design
- **A single aircraft or a composite of several different aircraft composed of the most demanding characteristics**
  - Approach Speed
  - Landing and Takeoff Distance
  - Cockpit to Main Gear Distance
  - Outer to Outer Main Gear Width
  - Wingspan / Tail Height
  - Maximum Takeoff Weight

Aircraft Characteristics

Manu-facturer	Aircraft	AAC	ADG	TDG	Wing-span	Tail Height	Length	CMG	Wheel-base	MGW Outer to Outer	MTOW	V_{REF}/ Approach Speed
					ft (m)	ft (m)	ft (m)	ft (m)	ft (m)	ft (m)	lbs (kg)	kts
Bombardier	Q400	C	III	5	93.3 (28.5)	27.4 (8.4)	107.8 (32.9)	- -	45.8 (14.0)	33.2 (10.1)	65,200 (29636)	129
Boeing	707-320B	C	IV	5	145.8 (44.4)	42.1 (12.8)	152.9 (46.6)	68.4 (20.85)		26.3 (8.02)	333,600 (151319)	128
Boeing	717-200	C	III	3	93.2 (28.40)	29.8 (9.08)	124.0 (37.80)	55.8 (17.00)	57.8 (17.62)	19.4 (5.90)	121,000 (54,885)	139
Boeing	717-200HGW	C	III	3	108.0 (32.9)	34.3 (10.4)	133.2 (40.6)	55.90 (17.04)		22.9 (6.98)	121,000 (54885)	139
Boeing	727-100	C	III	3	108.0 (32.90)	34.3 (10.40)	133.2 (40.60)	60.20 (18.34)		23.0 (7.01)	160,000 (72575)	124
Boeing	727-200	C	III	5	107.9 (32.9)	34.9 (10.64)	153.2 (46.7)	70.2 (21.40)	63.3 (19.29)	23.3 (7.10)	210,000 (95254)	133
Boeing	727-200/W	C	III	5	109.3 (33.30)	34.9 (10.64)	153.2 (46.70)	70.2 (21.40)	63.3 (19.29)	23.3 (7.10)	210,000 (95,254)	136
Boeing	737-100	C	III	3	93.0 (28.3)	37.2 (11.3)	94.0 (28.7)	39.1 (11.93)	-	20.9 (6.36)	110,000 (49895)	136
Boeing	737-200	C	III	3	93.2 (28.40)	36.8 (11.22)	100.1 (30.50)	42.7 (13.00)	37.3 (11.37)	21.0 (6.40)	128,600 (58332)	133
Boeing	737-300	C	III	3	94.8 (28.9)	36.6 (11.16)	109.6 (33.4)	45.9 (14.00)	40.8 (12.44)	21.0 (6.40)	138,500 (62823)	133

Taxiway Design Group (TDG)

- Straight Sections
  - Standard width remains the same as the old AC
  - The taxiway width (W) for each TDG is equal to the widest (MGW) plus the taxiway edge safety margins [2 x (M)]
  - Allowance for “wander” is captured by the edge safety margin criteria

- Fillet Geometry
  - Is determined by the combination of MGW and CMG
  - No relationship to wingspan, tail height or approach speed
  - There are no basis to compare any ADG with any TDG

Taxiway Pavement Width (W)

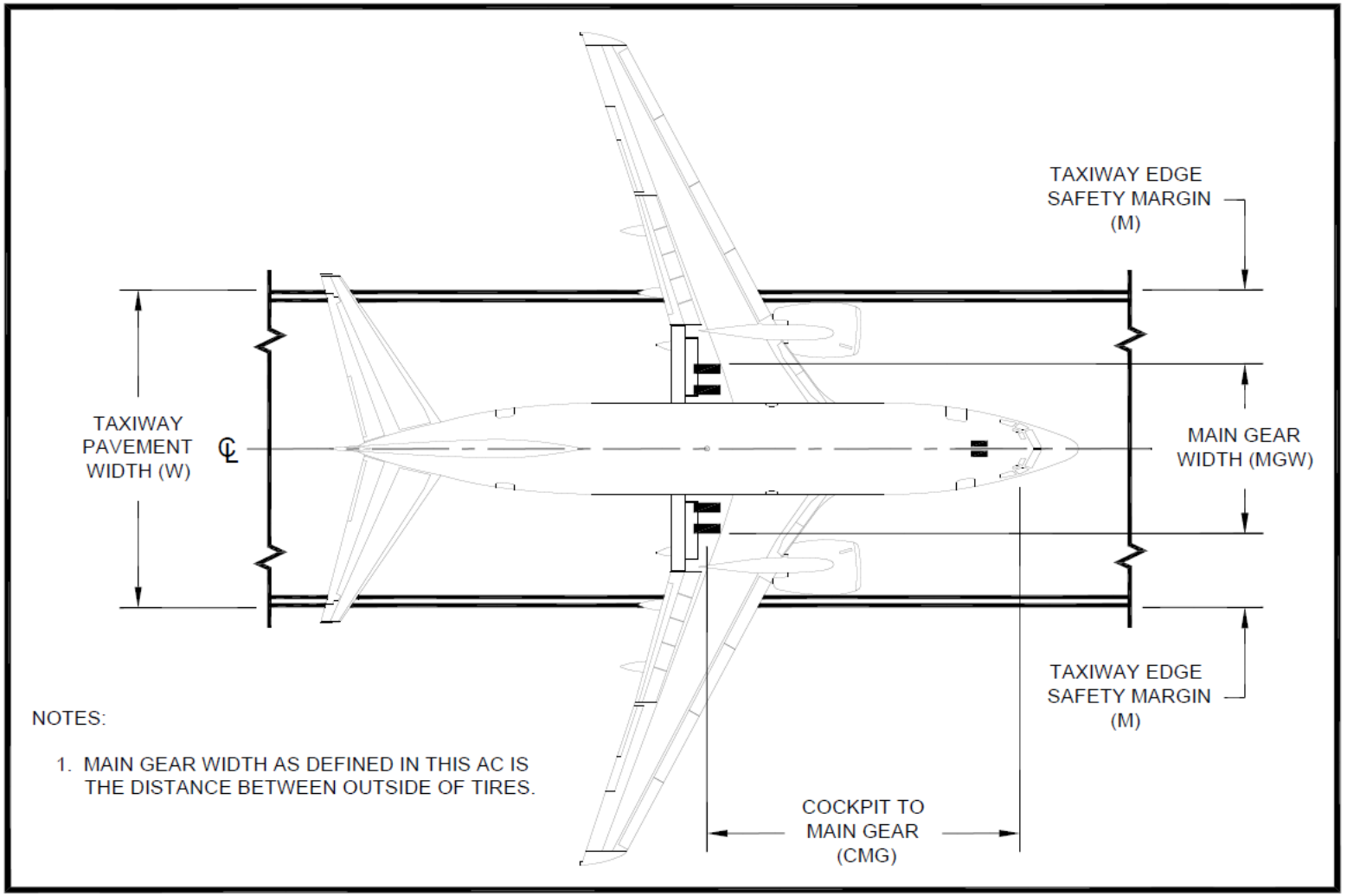
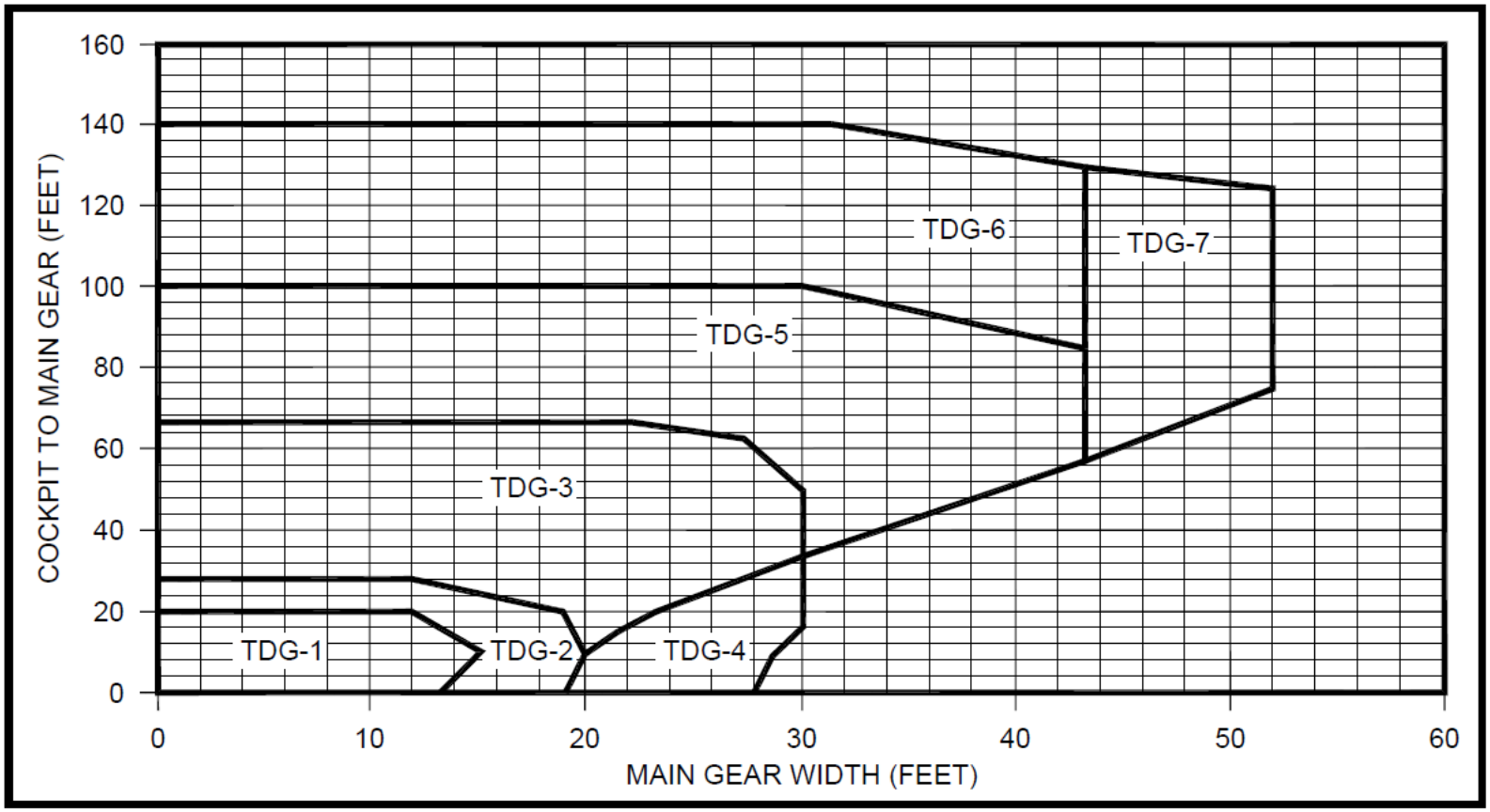


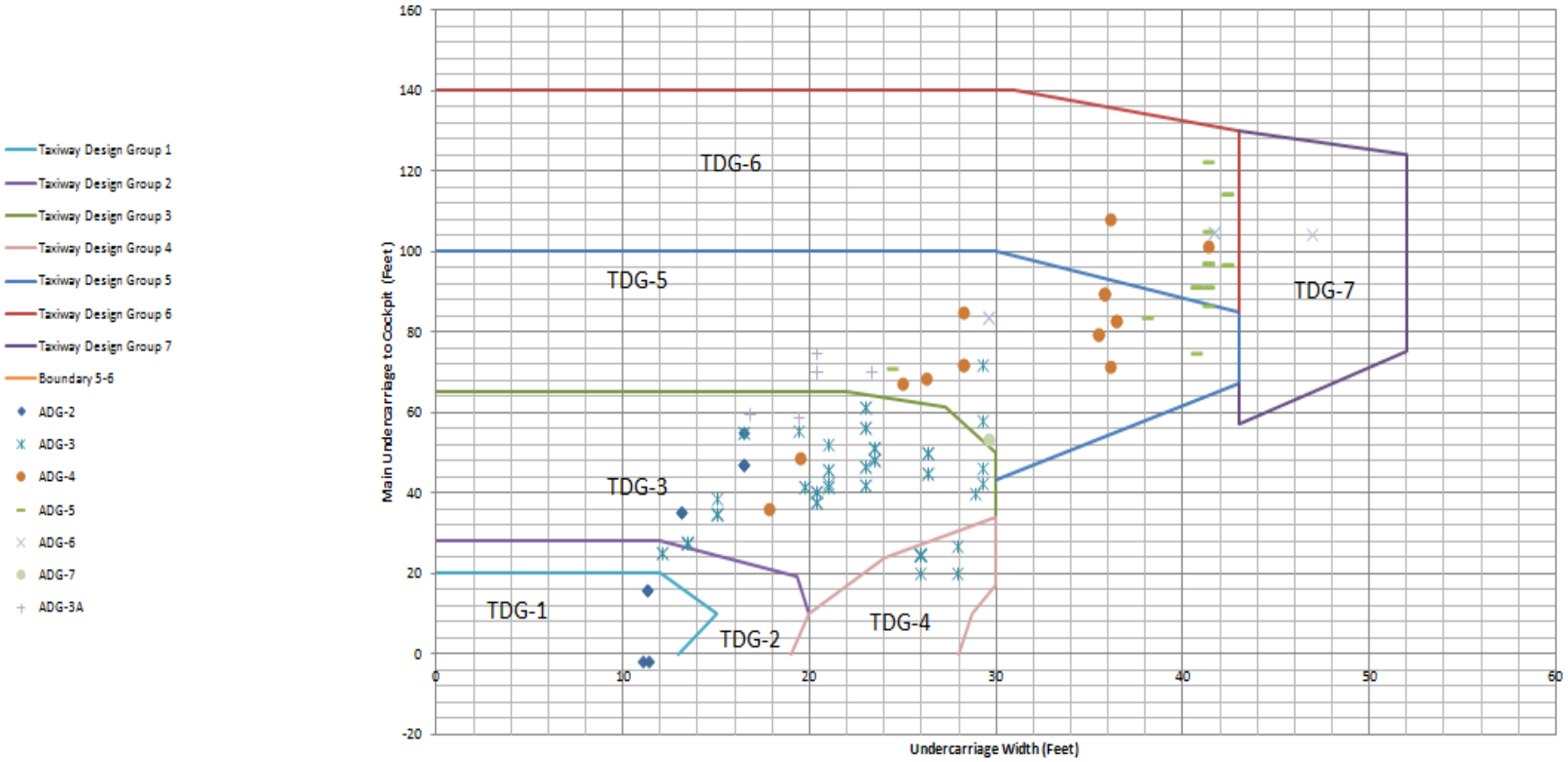
Figure 4-1


160
140
120
100
80
60
40
20
0
COCKPIT TO MAIN GEAR (FEET)
TDG-6
TDG-7
TDG-5
TDG-3
TDG-1
TDG-2
TDG-4
0
10
20
30
40
50
60
MAIN GEAR WIDTH (FEET)

TDG 6

Aircraft Manufactu	Aircraft Model	RDC		TDG	Wing span (ft)	Wing span (m)	Max Tail height (ft)	Max Tail Height (m)	Overall (max) Length (ft)	Overall (max) Length (m)	Cockpit to main gear distance (ft)	Cockpit to main gear distance (m)	Nose gear to main gear dist. [wheel base] (ft)	Nose gear to main gear dist. [wheel base] (m)	Outer Main Gear wheel span (ft	Outer Main Gear wheel span (m	Takeoff Weight (lb)	Takeoff Weight (kg)	Approach Speed (knots)
Boeing	747-100	D	V	6	195.5	59.6	64.3	19.6	231.0	70.4	91.9	28.0	84.0	25.6	40.7	12.4	753,000	341,555	144
Boeing	747-200	D	V	6	195.5	59.6	64.3	19.6	231.0	70.4	91.9	28.0	84.0	25.6	40.7	12.4	836,000	379,203	150
Boeing	747-300	D	V	6	195.5	59.6	64.3	19.6	231.0	70.4	91.9	28.0	84.0	25.6	40.7	12.4	836,000	379,203	152
Boeing	747-400ER	D	V	6	212.9	64.9	64.3	19.6	232.0	70.7	91.5	27.9	84.0	25.6	41.3	12.6	913,000	414,130	157
Boeing	747-400	D	V	6	212.9	64.9	64.0	19.5	232.0	70.7	91.5	27.9	84.0	25.6	41.3	12.6	875,000	396,893	157
Boeing	747-8	D	VI	6	224.4	68.4	62.7	19.1	250.2	76.3	100.1	30.5	97.3	29.7	41.8	12.7	987,000	447,696	152
Boeing	747-8F	D	VI	6	224.4	68.4	62.7	19.1	250.2	76.3	100.1	30.5	97.3	29.7	41.8	12.7	987,000	447,696	159
Boeing	767-400ER	D	IV	6	170.3	51.9	55.8	17.0	201.4	61.4	100.7	30.7	85.8	26.2	36.1	11.0	450,000	204,117	150
Boeing	777-200	C	V	6	199.8	60.9	61.5	18.7	209.0	63.7	94.8	28.9	84.9	25.9	42.3	12.9	545,000	247,208	136
Boeing	777-200ER	C	V	6	199.8	60.9	61.5	18.7	209.0	63.7	94.8	28.9	84.9	25.9	42.3	12.9	656,000	297,557	139
Boeing	777-200LR	C	V	6	212.6	64.8	61.5	18.7	209.0	63.7	94.8	28.9	84.9	25.9	42.3	12.9	766,800	347,815	140
Boeing	777-300	D	V	6	199.8	60.9	61.5	18.7	242.5	73.9	106.0	32.3	102.4	31.2	42.3	12.9	660,000	299,371	149
Boeing	777-300ER	D	V	6	212.6	64.8	61.8	18.8	242.5	73.9	106.0	32.3	102.4	31.2	42.3	12.9	775,000	351,534	149

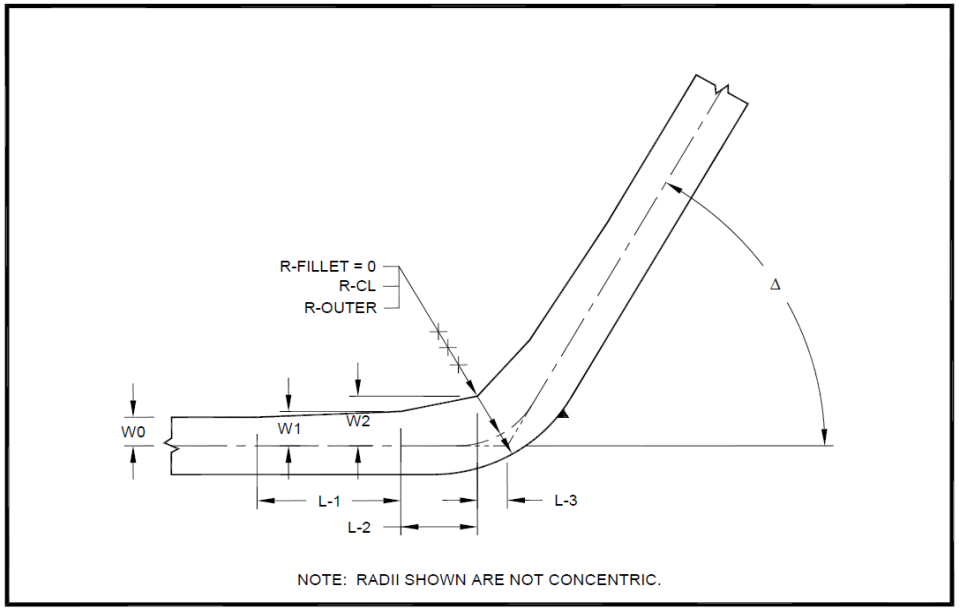
TDG vs. ADG

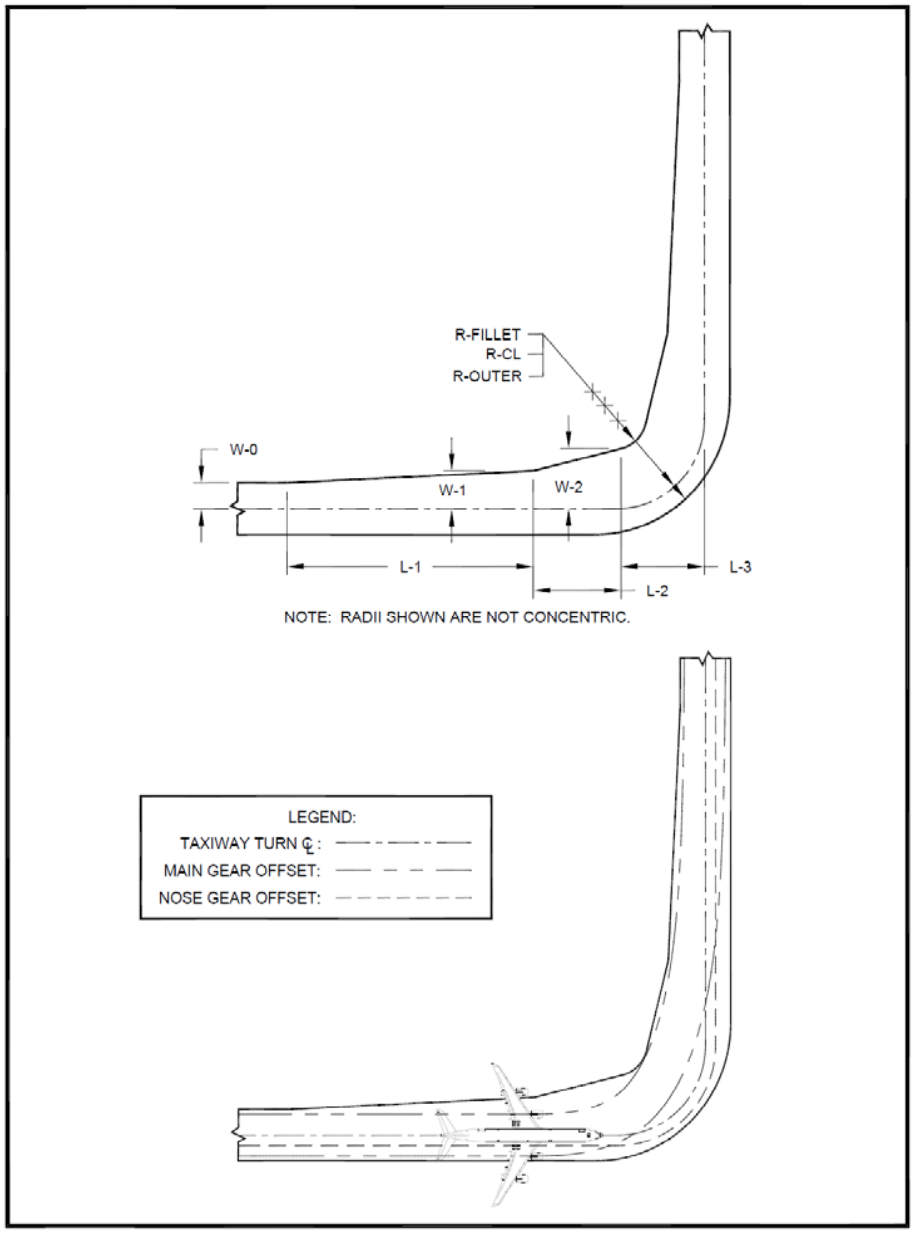

Taxiway Design Group 1
Taxiway Design Group 2
Taxiway Design Group 3
Taxiway Design Group 4
Taxiway Design Group 5
Taxiway Design Group 6
Taxiway Design Group 7
Boundary 5-6
ADG-2
ADG-3
ADG-4
ADG-5
ADG-6
ADG-7
ADG-3A
TDG-1
TDG-2
TDG-3
TDG-4
TDG-5
TDG-6
TDG-7
Main Undercarriage to Cockpit (Feet)
Undercarriage Width (Feet)
160
140
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60

Taxi Method

- “Cockpit Over Centerline” design - allows for the right amount of pavement to ensure the prescribed edge safety margin is maintained as the pilot guides the aircraft around turns while the cockpit follows the centerline.
- “Judgmental Oversteer” should not be used as a design technique intended to reduce pavement cost.
- Nose gear steering angle is no more than 50 degrees.
- Implement the “thee-node concept” for taxiway intersections.
- Design turns to be 90 degrees wherever possible.
- Intersection angles of 30, 45, 60, 90, 120, 135 and 150 are preferred.

Taxiway Turn





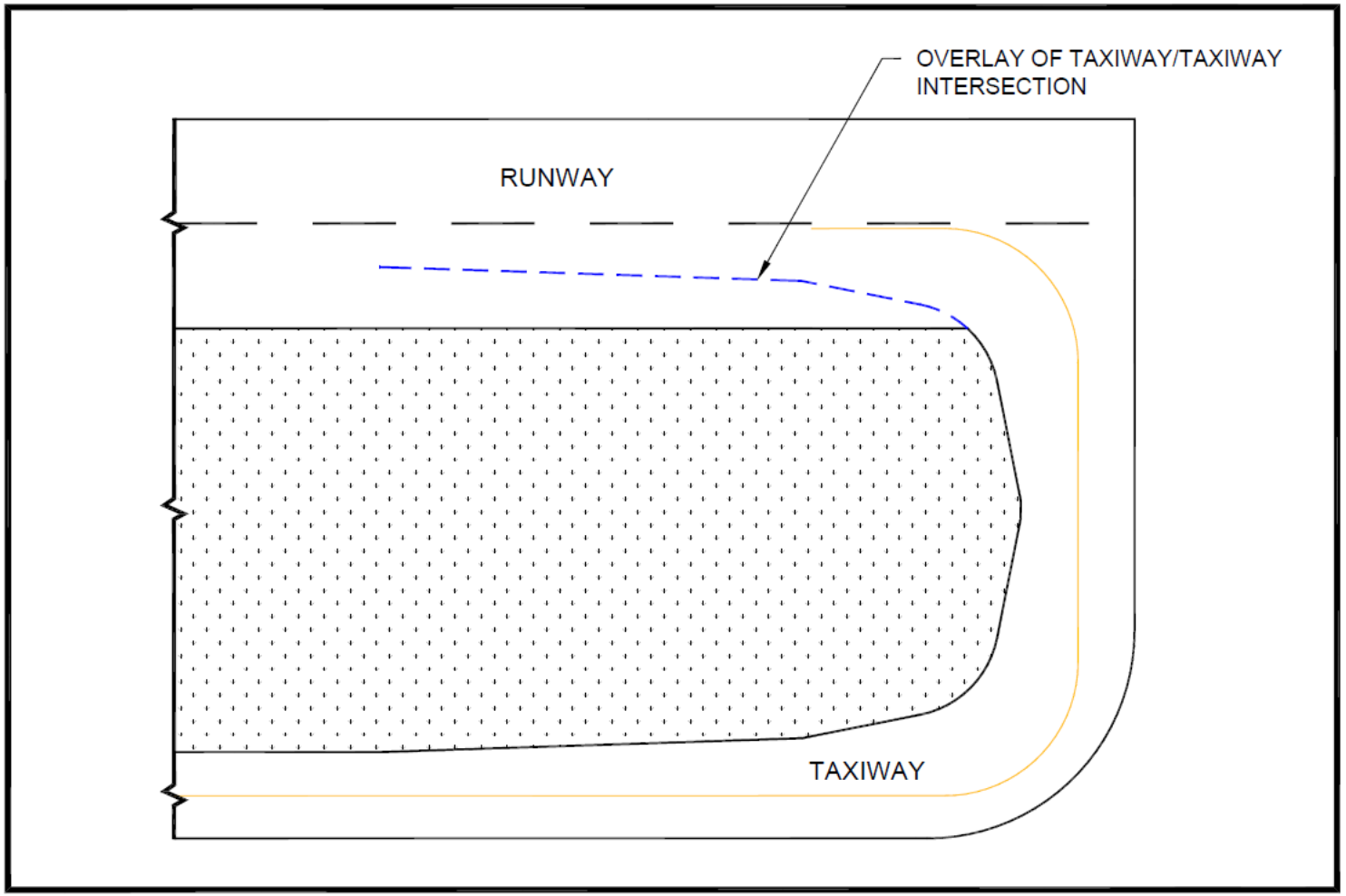
Standard Intersection Details

TDG 6								
Dimension (See Figure 4-13, Figure 4-14, Figure 4-15, and Figure 4-16)								
Δ (degrees)	30	45	60	90	120	135	150	180[3]
W-0 (ft)	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
W-1 (ft)	46	46	52	56	60	57	55	60
W-2 (ft)	60	71	82	85	95	102	107	105
W-3 (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	184
L-1 (ft)	300	300	345	365	400	363	360	395
L-2 (ft)	111	157	137	125	110	145	165	120
L-3 (ft)	16	30	47	129	246	373	594	141
R-Fillet (ft)	0	0	0	60	60	60	60	75
R-CL (ft)	150	150	150	130	155	165	170	175
R-Outer (ft)	400	300	265	200	207	210	212	N/A

Note: Values in the table are rounded to the nearest foot. 1 foot = 0.305 meters.

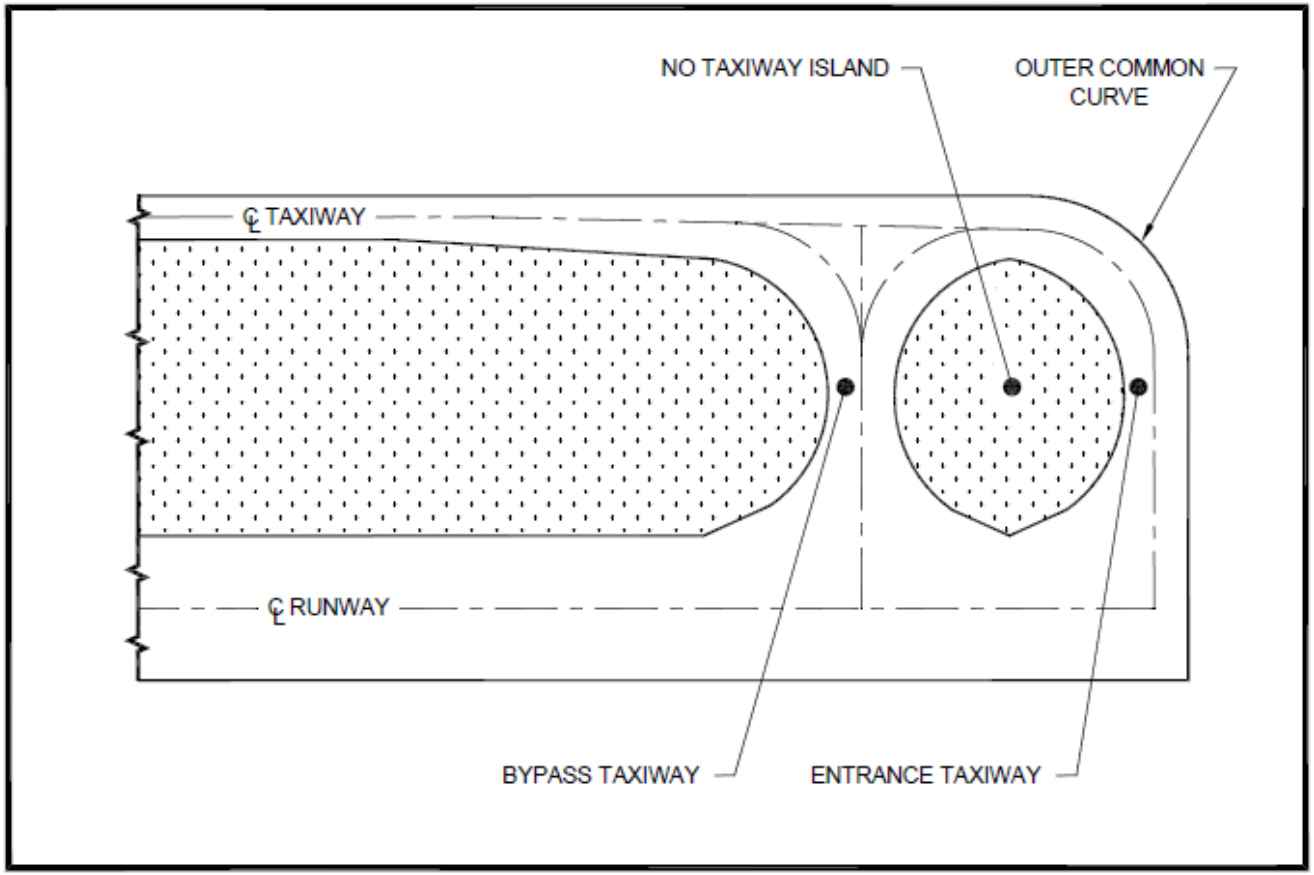
[3] This column refers to 180 degree turns between parallel taxiways. See Figure 4-16.

Entrance Taxiways

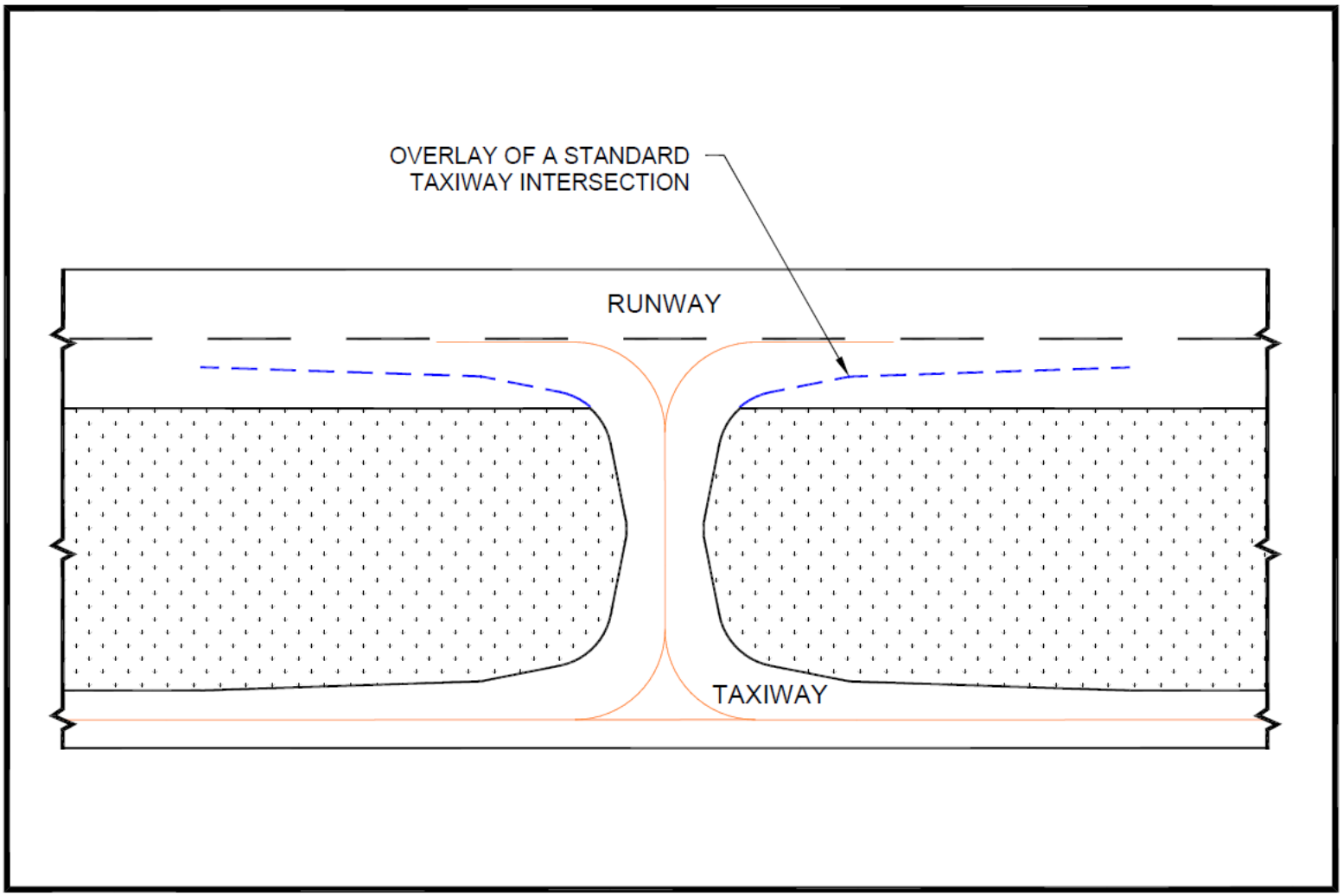


Entrance & Bypass Taxiways

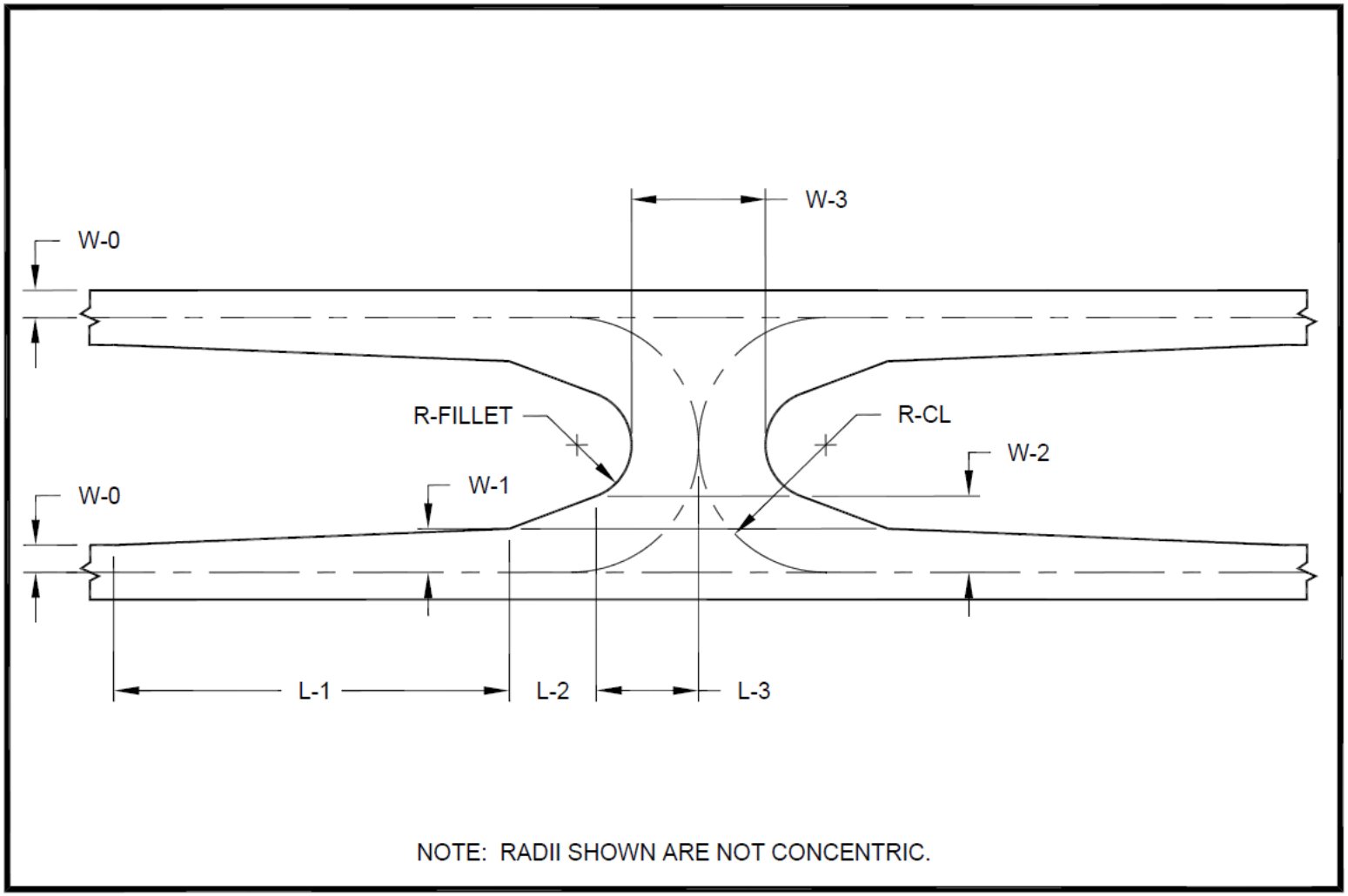
- ✓ Avoid wide expanses beyond taxiway design tables dimensions
- ✓ Islands provide location for elevated signage
- ✓ Standard orientation is 90 degrees
- ✓ Standard length to accommodate longest fuselage
- ✓ Curve “outer-edge” to mitigate wrong runway landing
- ✓ No Taxi-Island



Right-Angled Exit Taxiway



Crossover Taxiways



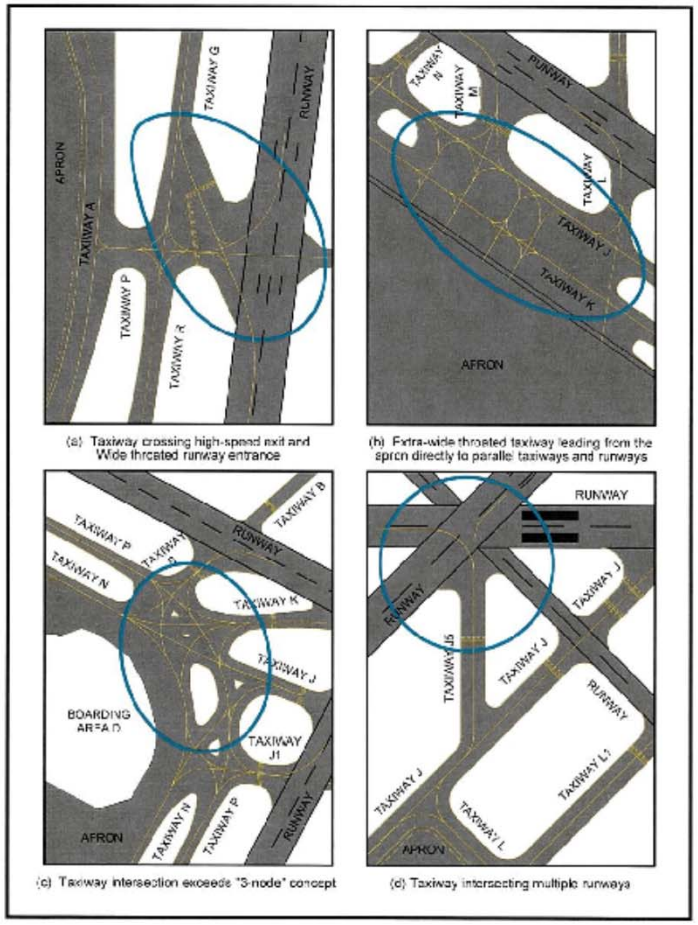


Figure 4-5. Taxiway designs that are not recommended (examples a, b, c, d)

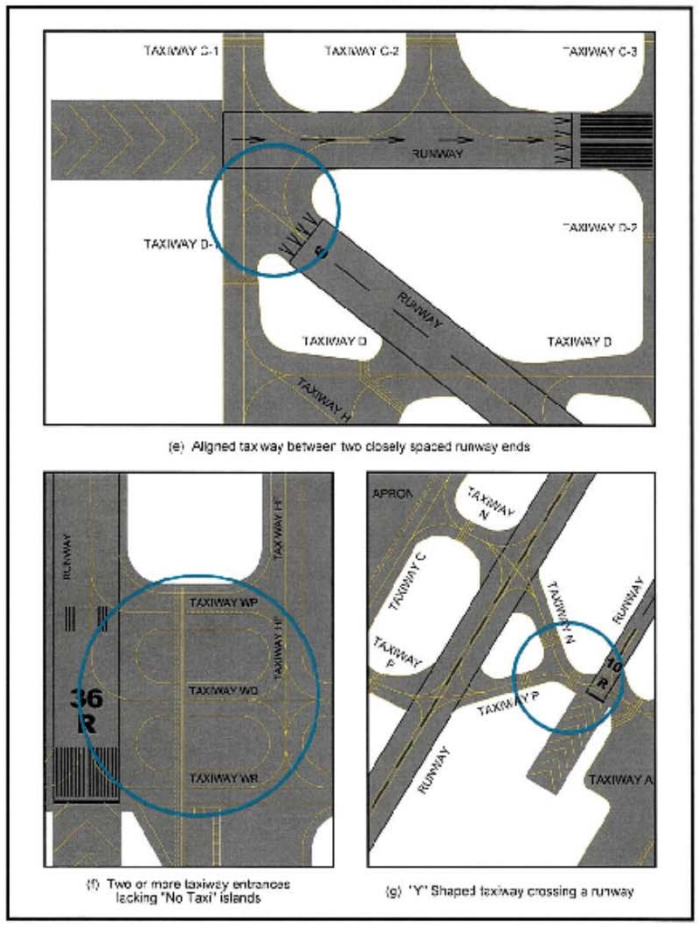
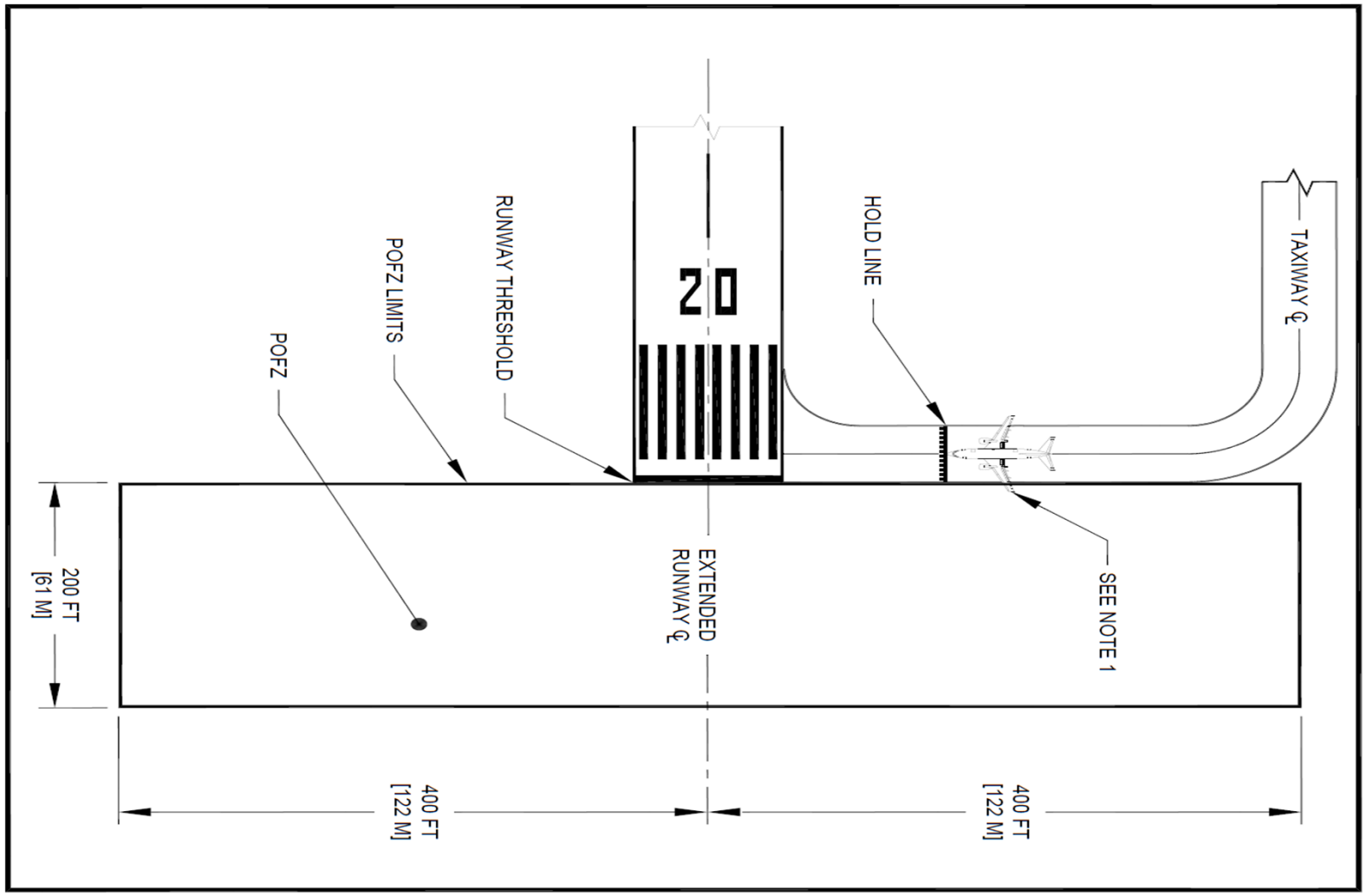


Figure 4-6. Taxiway designs that are not recommended (examples e, f, g)

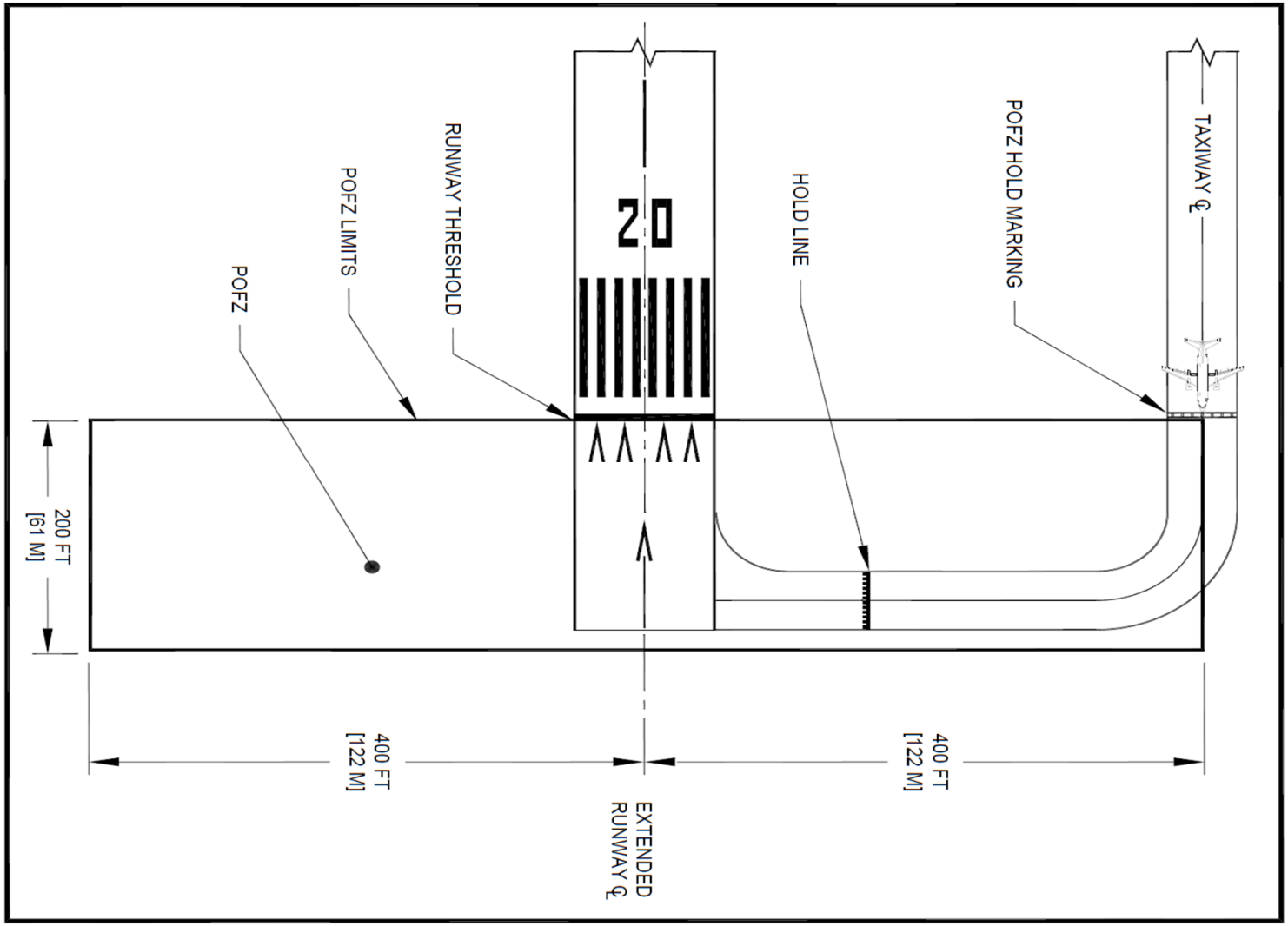
Paved Shoulders

ADG	I & II	III	IV to VI
Runways	Stabilize	Recommended	Required
Taxiways	Stabilize	Recommended	Required
Taxilanes	Stabilize	Recommended	Required
Aprons	Stabilize	Recommended	Required

Precision Object Free Zone (POFZ)



POFZ with Displaced Threshold



End Around Taxiway

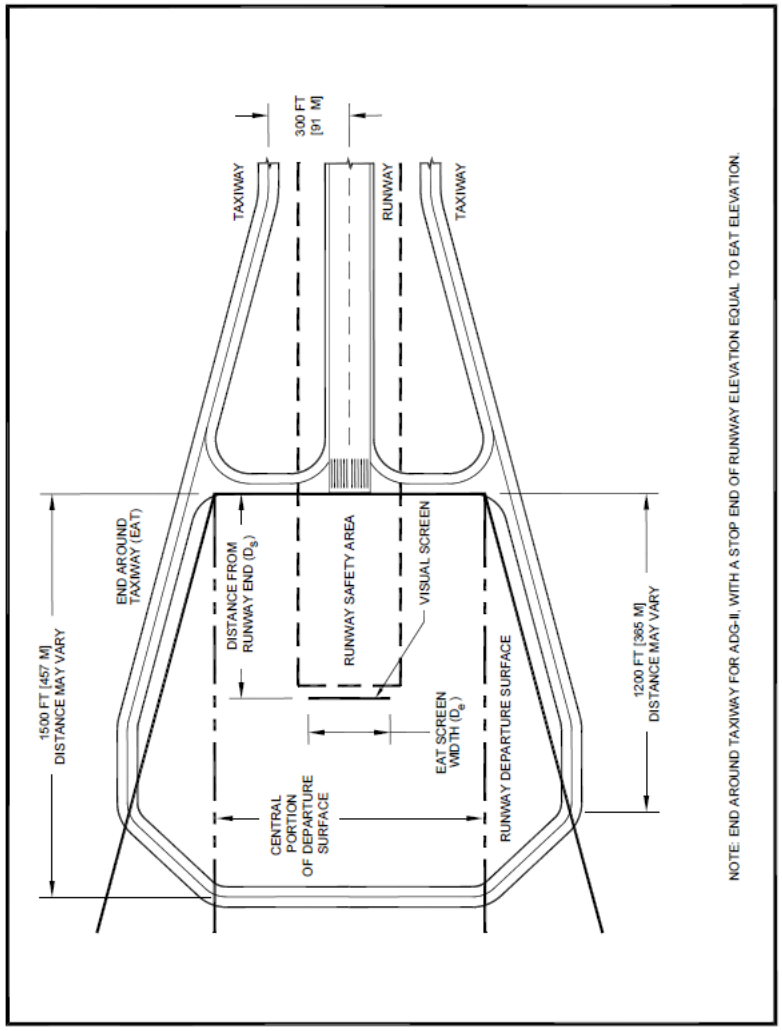


Figure 4-32. End-Around Taxiway (EAT) – ADG-II

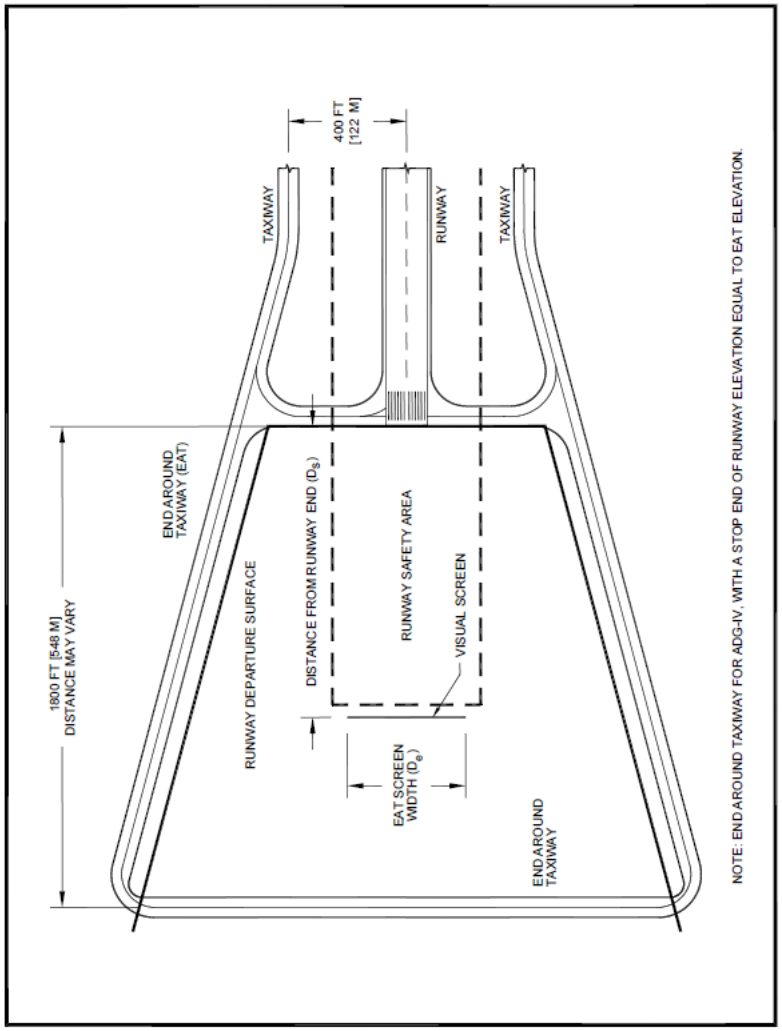


Figure 4-33. EAT – ADG-III

Airfield Development Alternatives

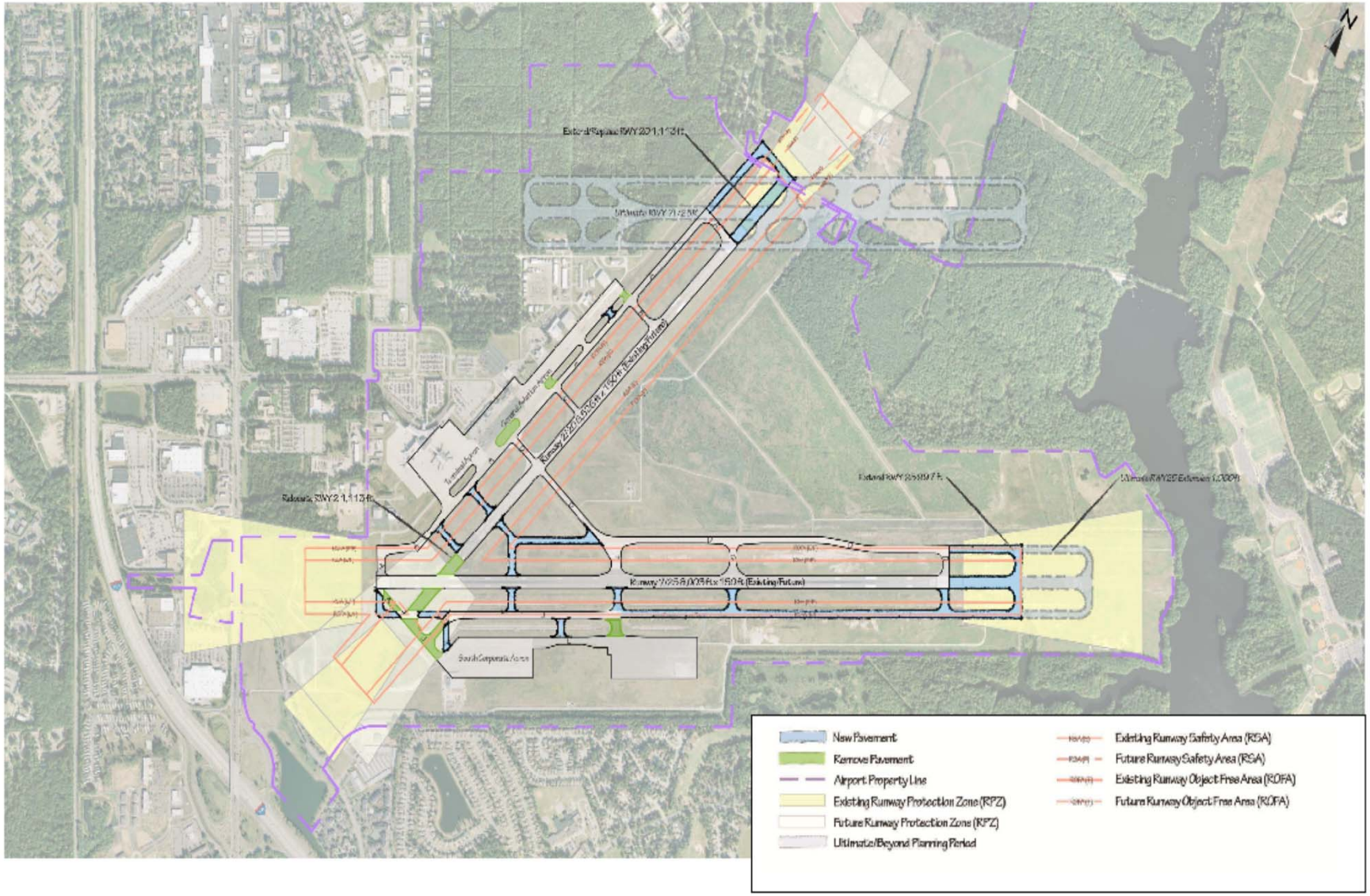


Figure 4-5
SPONSOR'S PREFERRED AIRFIELD DEVELOPMENT ALTERNATIVE

Aircraft Data Base – Appendix 1

- List of frequently used aircraft
- AAC RDC and TDG
- Aircraft Characteristics Database to be incorporated into Airport Design Section of the FAA Airport-GIS System in future.
- Manufacturer's data base – recent update
  - Airbus
  - Boeing

Wind Rose – Appendix 2

- Wind Analysis program added to the public side of FAA Airport Surveying-Geographic Information System website:

  https://airports-gis.faa.gov/public/index.html
- NOAA no longer provides wind data in 36 segment format.

Runway Design Standard Matrix

Runway Design Code (RDC):
(select RDC from pull-down menu at right)

ITEM	DIM[1]	Visibility Minimums: Visual	Not Lower than 1 mile	Not Lower than 3/4 mile	Lower than 3/4 mile
Runway Design					
Runway Length	A	*Refer to paragraphs 302 and 304*			
Runway Width	B				
Shoulder Width					
Blast Pad Width					
Blast Pad Length					
Crosswind Component					
Runway Protection					
Runway Safety Area (RSA)					
Length beyond departure end	R				
Length prior to threshold	P				
Width	C				
Runway Object Free Area (ROFA)					
Length beyond runway end	R				
Length prior to threshold	P				
Width	Q				
Runway Obstacle Free Zone (ROFZ)					
Length		*Refer to paragraph 308*			
Width		*Refer to paragraph 308*			
Precision Obstacle Free Zone (POFZ)					
Length					
Width					
Approach Runway Protection Zone (RPZ)					
Length	L				
Inner Width	U				
Outer Width	V				
Acres					
Departure Runway Protection Zone (RPZ)					
Length	L				
Inner Width	U				
Outer Width	V				
Acres					
Runway Separation					
Runway centerline to:					
Parallel runway centerline	H	*Refer to paragraph 316*			
Holding position					
Parallel Taxiway/Taxilane centerline	D				
Aircraft parking area	G				
Helicopter touchdown pad					

Notes:
1. Appendix 7 contains non-interactive tables for all RDCs.
2. Values in the table are rounded to the nearest foot. 1 foot = 0.305 meters.

Interactive Form